THE MODEL ENGINEER

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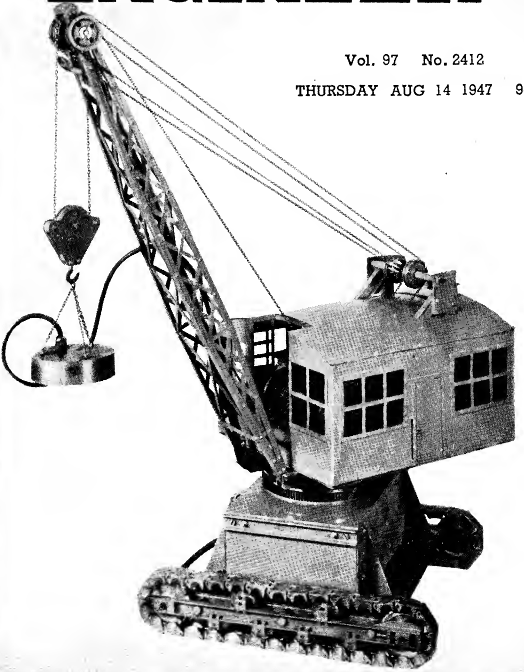


The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

14TH AUGUST 1947 VOL. 97. NO. 2412

SMOKE RINGS

Our Cover Picture

● THE MAIN roads in model engineering tend to lead in the direction of locomotives, traction engines, petrol motors, and speed boats, but there are some interesting by-ways to be explored. One of these is that concerned with cranes and lifting appliances, and I am pleased to be able to present a cover picture this week illustrating an exceedingly good model jib-crane with a caterpillar track, the work of Mr. D. A. Crabtree. This model will be on view in the competition section of our forthcoming exhibition, and I am sure its neatness of conception and construction will find many admirers.

The Exhibition is at Hand

● NEXT WEDNESDAY, the 20th, will see the opening of our 22nd exhibition. I need hardly say that this has been on my mind for several months past; I have seen it shaping by degrees under the capable guidance of our Exhibition Manager, Mr. E. D. Stogdon, and I am looking forward as much as anybody to a wonderful show. Its preparation has been a remarkable collective effort on the part of many people, the architect, the competitors, the trade exhibitors, the stand fitters, the club members, the printers, and indeed everybody concerned in the work has been determined to make it a "best ever" event, and I feel convinced that our friends, the visiting public, will not be disappointed. It opens at 12 noon on the 20th and at 11 a.m. on the following days. Come early, and come often. We shall be pleased to see you, and I know you will enjoy it.

A Successful Gala Day

● I HEAR that the Gala Day organised by the Northern Heights Model Flying Club was an outstanding success. Reliable estimates put the attendance at the Langley Aerodrome at 15,000 and with fine weather and a splendid entry of models, some excellent flying was achieved. Well-deserved congratulations were received from the Minister of Civil Aviation, The Royal Aeronautical Society, and other important authorities, while H.M. the Queen honoured the occasion with an inspiring message of good-will.

Power Boating in Paris

● A WELCOME letter from M. Gems Suzor tells of a successful power boat meeting held on July 6th at Vésinet, near Paris, under the auspices of the Federation Motonautique de France. Twelve boats of 10-c.c. motors, and three of 30-c.c. put in an appearance. The fastest run over a course of 500 metres was made by *Puck*, fitted with a Hornet motor, and belonging to M. Brugerolle. The course was covered in 22 2/5 seconds, practically 49 m.p.h., which constitutes the French record for 1947. M. Suzor says that there are at least four boats capable of attaining this speed, and that great enthusiasm prevails among the newcomers to the sport.

Operations at Huddersfield

● AN OUTDOOR "operating centre" has been acquired by the Huddersfield Society of Model Engineers at Greenhead Park, Highfield. A passenger-carrying track 150 ft. long has been installed with gauges of 3½ in. and 5 in. This, it

is hoped, will be extended and additional gauges of $2\frac{1}{2}$ in. and $7\frac{1}{4}$ in. laid down. For the boating enthusiast there is a pool measuring 150 ft. by 50 ft. and 9 in. in depth. This at one time was used as a curling rink, but I should imagine that when filled with water and alive with boats it will have a much more prolonged spell of yearly activity and popularity.

A Machine Tool Exhibition

● I AM informed by the Secretary that the Machine Tool Trades Association will stage an International Machine Tool and Engineering Exhibition at Olympia in August, 1948. This, it is claimed, will be the first machine tool show in London since the Association's Exhibition at Olympia in 1934.

Memories of Maxim

● I RECENTLY had the pleasure of an after-lunch chat with Dr. A. P. Thurston, the well-known specialist in aeronautical science and for many years one of the most enthusiastic supporters of the model aircraft movement. He was intimately connected with that great inventor Sir Hiram Maxim, when he was engaged on his memorable pioneer experiments in aviation. We discussed auto-gyros and helicopters and Dr. Thurston told me that the possibilities of these machines were fully realised even in the early days, fifty years ago, and many actual model experiments were made. But he also related some of the other workings of Sir Hiram Maxim's inventive mind, one of which was concerned with no less a mundane subject than cooking. He told me how on one occasion when visiting Sir Hiram's workshop he noticed that mechanical work seemed to be temporarily suspended and that the workshop atmosphere was pervaded with a strong smell of cooking apparently proceeding from an adjoining room. Sir Hiram propounded an unexpected question. "Tell me," he asked " why the Americans are such a superior race to the British, so much more virile and mentally alert." He waited a moment and then added " I'll tell you the answer—it's pork and beans! If the British people could only be persuaded to adopt this diet, they would be a hundred per cent. more active and efficient, and I propose to show them how pork and beans should be cooked." History does not relate how far Sir Hiram proceeded with his catering experiments nor what effect his prescription has had on British engineering, but there's a hint to the rising generation if their ration books permit. Dr. Thurston then told me of another occasion when Sir Hiram asked him if he knew how much of the wheat crop in this country was consumed by crows. When imaginary statistics had been compared Maxim showed him his latest invention, a device which through a combination of mechanical and chemical elements exploded a charge of powder every fifteen minutes, thus scaring the crows away from the wheat for a mile or so around. A true engineering improvement on the usual straw-stuffed dummy, but I doubt if it ever made much appeal to farmers. These little stories are interesting as showing the strange workings of a master mechanical mind, but we may remember how often the stray conception of an active brain has resulted in an invention of outstanding benefit to the human race. When I mention that my chat with Dr. Thurston ranged over such diverse topics as the fourth dimension, the structure of the atom, and the possibility of the every-day application of devices for neutralising the effect of gravity, it will be seen that our thoughts wandered far afield from the design of model aircraft about which we had started to talk. But it was all most interesting, and became even of a domestic importance when the learned Doctor told me of his second hobby, fruit growing, and expressed his opinions confidentially but very strongly on the prevailing retail prices of fruit and vegetables. That subject, however, is out-of-bounds for THE MODEL ENGINEER!

The Wrong Address

● A NOTE from The Model Engineering Co. Ltd., of 6 to 10 Addison Avenue, W.11, tells me that they are continually receiving either letters or 'phone calls intended for us but wrongly addressed to them. I have known of this old-established firm for many years and I am sorry that they should have been inconvenienced in this way. I do not imagine that the misdirection is caused by any of our regular readers or customers, but it probably arises from someone being told to write to THE MODEL ENGINEER and then turning up the words " Model Engineering " in the telephone directory; they find the above firm immediately above our own entry. We have only one postal address in London, 23, Great Queen Street, W.C.2, so if you can help to spread this information around I should be glad. Our telephone number is Chancery 6681.

Engineering Degrees

● MANY YOUNG engineers in seeking professional advancement are naturally anxious to be able to produce some recognised testimony to their technical qualifications as instanced by a university degree or college diploma, or membership of a suitable grade in a leading professional institution. There are now so many bodies granting recognition of this kind to approved students that some guidance as to the opportunities available will no doubt be widely appreciated. This guidance will be found admirably and authoritatively set out in a pamphlet entitled "Engineering and Technical Qualifications," issued by the Advisory Bureau for Research, 70, Victoria Street, London, S.W.1. It not only gives the details of the examinations required for University degrees and other proficiency certificates, but also the conditions of membership of the leading engineering institutions and their addresses. Altogether it is a most helpful brochure for the young engineer in enabling him to direct his studies in the most approved channels.

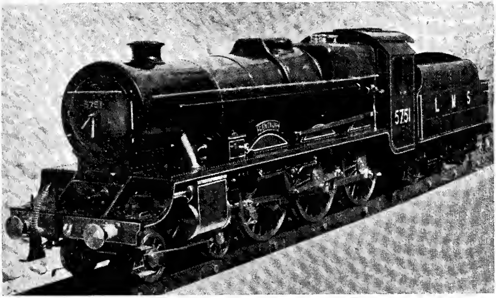
Percival Marshall

WHAT TO SEE

AT THE 1947 "MODEL ENGINEER" EXHIBITION

Part 2—The Models, Clubs and Loan Exhibits—by Percival Marshall

IN endeavouring to write a forecast of the magnificent display of models which awaits the visitor to this year's Exhibition, I am confronted with a list of entries which bids fair to surpass any previous show. Our move last year into a larger hall was thought to solve the problem of finding space for all the exhibits for some time to come, but this year's show will be packed as tight as ever, and as full of interest. Not only is the number of entries a very pleasing sign of the times, but I venture to say that in quality the standard of craftsmanship will be found as high as it has ever been. The exhibition will indeed not only demonstrate the amazing vitality of the hobby, but, equally important in the national interest, it will show that fine craftsmanship is in no danger of declining amongst model engineers and ship modellers.



A 5-in. gauge L.M.S. locomotive " Centaur." By Mr. J. I. Austen-Walton. (Competition section)

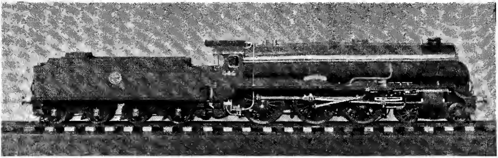
The response of the Clubs to the offer of a Club Championship Cup has been most gratifying, particularly as it has brought to light the remarkable talent to be found among the membership of clubs which have not previously enjoyed the opportunity of collective representation at the Royal Horticultural Hall. Every club exhibiting its work, whether it carries off the cup in triumph or not, will be able to feel that it has really achieved an honourable place on the model engineering map and has brought well-deserved fame and appreciation to its members. I can imagine that no exhibits will be more closely examined than those in the club circle.

I hoped that we should be able to display the club entries as separate collective exhibits, the models from each club being shown together. Further consideration of this plan has, however, shown that it would have the effect of disturbing the grouping of the individual competition entries, making the work of the judge much more difficult and inconvenient. The club models will therefore take their normal place in the Competition section, but they will be marked up on behalf of the clubs concerned, and the Cup awarded accordingly. Credit to the clubs for their entries will be duly made in the Exhibition catalogue.

It will, I hope, be understood that in selecting certain entries for mention or illustration in these notes, I am not in any way anticipating the work of the judges. I am merely directing attention to some of the exhibits which I know will be of interest and worthy of

careful inspection. This exhibition, as is so often the case, will no doubt provide some surprises. Very modest claims on an entry form may result in an exhibit of exceptional merit; no opinion can be expressed until the work is actually placed on view. The judges are fully competent and I shall await their decisions with as much interest as anybody. They will undoubtedly have a very busy time.

own design. I am pleased to welcome a new entrant in the larger locomotive class in the person of Mr. W. D. Hollings of the West Riding Small Locomotive Society who shows a 3½-in. gauge free-lance engine *Princess Elizabeth* which has done much duty on the track and has a special water pick-up fitting. Mr. Hollings also contributes to the loan section a partly-finished version of his latest engine. Mr. N. E. Nicholson

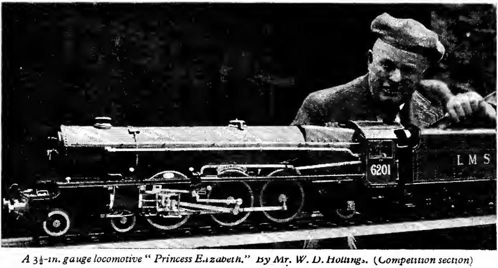


A 3½-in. gauge coal-fired locomotive by Mr. A. W. G. Tucker. (*Competition section*)

Locomotives and Railways

This will be what I believe is called a "banner" year for the railway folk, for, both with the larger scale locomotives and in the smaller railway groups, the entries are very numerous and of outstanding quality. There is a record entry of the smaller gauge locomotives, rolling stock and accessories, and it is pleasing to see so many clubs taking part. I may mention Conway, Ilford and West Essex, Bristol, Harrow, Birmingham, Model Railway Club, Manchester and Blackpool as some of the clubs represented. Mrs. Austen-Walton whose locomotive took the Admiral's Cup last year will be represented by a 2½-in. gauge free-lance tank locomotive of her

of Sheffield has a 3½-in. gauge working model *Princess Royal* which has gained exceptional honours at the Sheffield Society's Exhibition, including the local Championship Cup, the President's Cup, and a first prize. Mr. Nicholson says that so far he has never seen the prototype of his model. A particularly impressive entry comes from Mr. J. I. Austen-Walton of Worthing; this is a 1-in. scale 5-in. gauge L.M.S. locomotive *Centaur*, built for passenger hauling and fitted with a special valve gear. Other locomotives which will call for a close inspection are Mr. A. W. G. Tucker's 3½-in. gauge engine *Lady Anna*, based on the S.R. "Lord Nelson" class, Mr. F. R. Forest's 2½-in.



A 3½-in. gauge locomotive "Princess Elizabeth." By Mr. W. D. Hollings. (*Competition section*)

gauge L.N.E.R. *Flying Scotsman*, Lt.-Col. Grover's 3½-in. gauge G.W.R. "King George VI," Mr. Ernest Kench's 3½-in. gauge 3-cylinder *Royal Scot*, Mr. Wm. England's ½-in. scale *Princess Royal* (a first attempt), Mr. H. E. Seaken's ½-in. scale Pacific type, Mr. W. G. Dennis's 1½-in. scale saddle tank engine (described in the "M.E." of September 12th, 1946) and the unfinished 1½-in. scale *Royal Scot* from Mr. C. S. Barnett of Andover. These will all make a fine array of locomotive talent.

exhibits are some of very varied and attractive interest. Mr. David Kydd of Gloucester sends a miniature set of engineers' tools, Mr. John S. Eley of Leeds a gear-cutting machine and Mr. J. R. Mann an 8-in. stroke power driven shaper. Mr. G. T. Williams shows an "M.E." beam engine. From previous experience of his work I know this will be a fine exhibit. Competitors of previous years are Mr. Fred Smith of Pinxton and Mr. C. B. Reeve of Hastings. The former sends a model of an old-type coal-winding gin,

Model showman's 3-abreast gallopers, by Mr. J. E. Bosley. (Competition section)

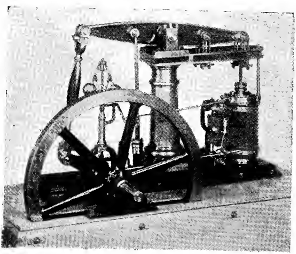
Traction Engine Models

This class will be notable for its fine collection of traction and farm engines among which an old friend Mr. F. G. Bettles of Taunton is represented by a fine free-lance road locomotive of experimental design. Andover sends a Tasker Portable Engine by Mr. Herbert Smallbones, and a showman's road locomotive by Mr. D. T. Wicks, built, as he says, from "odds and ends." Several engines based on the "M.E." design by Henry Greenly are among the entries from Mr. Wm. C. Gould (no castings used), Mr. F. B. Read and Mr. R. N. Yeaman (spirit fired). Mr. F. J. Bretherton of Oxford shows a Robey 7 h.p. general purpose engine, and Mr. G. A. Froud of Weybridge puts in a 4-spindle traction engine. Other notable entries in this class are the 1½-in. scale showman's compound road engine by Mr. D. J. Unwin, the 1½-in. scale 8 h.p. Marshall tractor by Mr. R. Palmer, and the 1¼-in. scale road haulage engine by Mr. L. Shepherd.

General Models and Tools

Among what may be termed miscellaneous

horse driven, the original built in 1844 and still in working order, while Mr. Reeve, known to us for his horological skill, sends a handsome 8-day clock with gravity escapement. Other types of engineer interest will be Mr. C. H. Newell's 4-cylinder petrol engine, and the model refrigeration condensing unit by Mr. John McCreesh. Among spectacular models I note Mr. A. V. Rustein's model of the White Hart Inn, famed in "Pickwick Papers," Mr. J. E. Bosley's showman's 3-abreast "gallopers," with organ music, and lighting effects, and two entries by Miss Florence Palmer, who won the Admiral's Cup in pre-war days for a fine model of a farm wagon and team of horses. This year she sends a model of a hansom cab, and the "Victory" coach with four horses, marked "London to Berlin" and having Mr. Winston Churchill on duty as the guard. Mr. D. A. Dubbin sends a group of locomotive models, some in cardboard and some in that novel constructive material—calico. Other exhibits in this group will be Mr. D. A. Crabtree's electric crane, Major D. H. Hayden's "M.E." Ciné Projector, and a very complete scale model of an Austin 12 h.p. car by Mr.

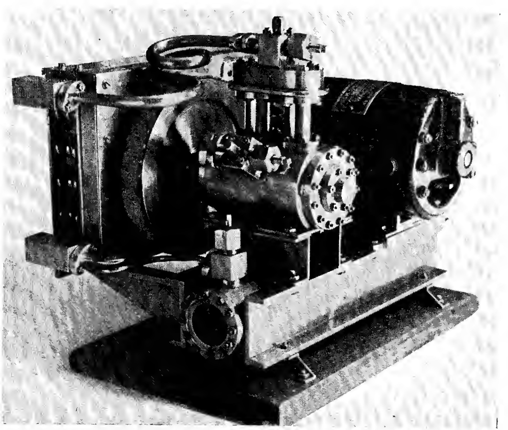


"M.E." beam engine, by Mr. G. T. Williams. (Competition section)

G. C. S. Seyman of Worthing. Motorists will also be interested in Mr. F. E. Backshell's working model of a Mercedes-Benz racing car, fitted with a 5-c.c. engine. Several architectural models will make an interesting change of subject, a notable example being a period street scene, and an Elizabethan inn, both by Mr. Wm. Margolis.

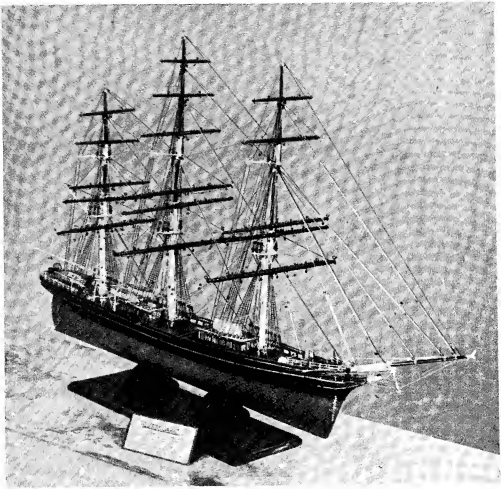
Ship Models

The ship model section is well up to the high standard customary at our exhibitions, both old-timers and modern vessels being included in great variety. Among the former will be noted the model of a 74-gun line-of-battle ship by Capt. John Shenton, R.N. (Ret.), the waterline model of the Elizabethan ship *The Pelican* by Mr. V. O. Lawson, the galleon of 1600 period by Mr. Leonard Glass of Bristol, and the all-metal model of the *Royal Sovereign* of 1634 by Mr. A. R. Garland. Coming to a later period we shall see the *Norman Court* by Mr. J. F. Alderson, the



Model of a 3 h.p. refrigeration condensing unit. By Mr. J. McCreesh. (Competition section)

Caliph by Mr. W. George, and the *Cutty Sark* by Mr. George Miller. The *R.M.S.P. Asturias* by Mr. E. Kilner Berry was built from plans and sketches made on board when he served during her commission as a hospital ship. model in Perspex is sent by Mr. James McGuffie. An excellent entry of miniature models of various types adds much to the interest of this section. Lt.-Com. J. H. Craine will again be on duty in charge of all the ship models.

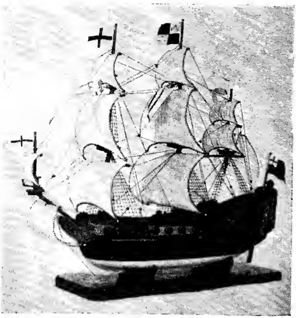


Model of the "Cutty Sark," by Mr. G. Miller. (Competition section)

Thames barges will be well represented by two of the *Lady Daphne* by Mr. A. B. Hancock and Mr. M. C. Lawrence respectively, by the *Giralda*, a first attempt by Mrs. Iris McNarry, and by a coastal barge by Mr. C. H. Stanley. A well-tried speed boat of the displacement type, *Atomic II*, comes from Mr. Leslie V. See of Portsmouth, while Mr. R. G. Bosberry of the same club shows a $\frac{3}{4}$-in. scale Vosper M.T.B. 500 class. Mr. G. M. Baillie of Shanklin shows a patent robot rowing boat, Mr. A. M. Welter a radio controlled cabin cruiser, and another example of radio control is shown in a cruiser of the "Town" class by Mr. F. C. Chapman and Lieut. G. C. Chapman, R.N., jointly. A warship

Utility and Ingenuity

This class has certainly set some of the nimble brains and fingers in motion, and the entries, 27 in number, are remarkable in their variety and ingenuity in the use of odds and ends and scrap material. They will speak for themselves at the show, but I feel I must select one entry for honourable mention even at this early stage. It is a model of a double-sculling pleasure skiff and sculls made by Mr. George Fallowfield of Southwick who is an ex-service man starting with the handicap of being both blind and deaf. He has been trained by St. Dunstan's as a basket maker, but has a shed workshop, with hand tools, where he makes his models He measured



Model galleon "Royal Prince." By Mr. W. George. (Competition section)

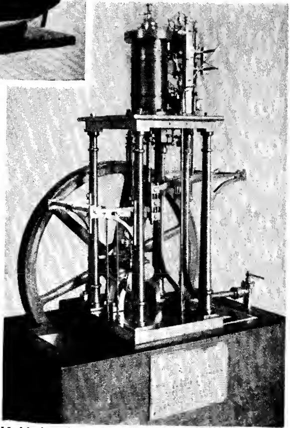
up an actual craft for his dimensions, and his only purchased materials were six small screws.

Working Models

A novel and very appropriate addition to the Exhibition this year will be a specially constructed working models arena. This will be circular in form, 50 ft. diameter, and will provide a track for model racing cars, a tank for model ships and boats, and a device for showing model aircraft in flight. It will be under the supervision of Mr. Basil Lavis. Demonstrations at frequent intervals will be provided by the Pioneer Model Racing Car Club, The Model Power Boat Association, The Society of Model Aeronautical Engineers, and some of the trade firms who have interesting working models which they wish to show in action. Pressure on our space will, I am afraid, prevent us showing any model traction engines under steam, as we had hoped to do, if a suitable floor space could be found. For the same reason there will be no locomotive passenger track in operation as in previous years. Although this was always a very popular feature, and one which may come again, it was felt that this year we should give other types of working models an arena for themselves, and so add variety of interest to the show. A particularly attractive working model railway will be featured by the Ilford and West Essex Model Railway Club who have spent many hours constructing a lay-out for the show

Club Stands

We have only been able to allot a limited amount of space to individual stands for clubs but I am pleased to report that the Society of Model and Experimental Engineers will have a representative exhibit at their stand on the Dais where full information regarding membership may be obtained. Model aircraft interests will be represented by the Society of Model Aeronautical Engineers, also on the Dais. This Society is responsible for the organisation of the model aircraft section of the Competition, and for the demonstrations of model aircraft



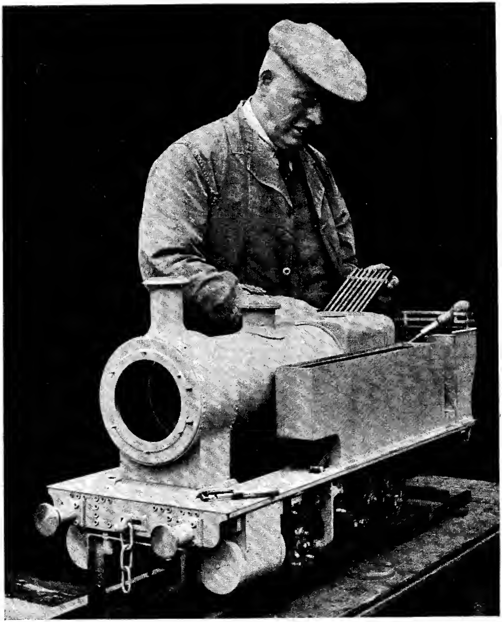
Model pit engine, with Watt's valve gear. Made by George Ogle, 1862. Lent by Mr. E. J. Howlett. (Loan section)

in flight in the Arena. Other club stands which will well repay a visit are the combined exhibit by the Ship Model Societies and the Model Yachting Association, the Radio Control Model Society, Harrow Model Railway Society and

the Model Power Boat Association. The Pioneer Model Racing Car Club will be represented by demonstrations in the Arena.

Loan Exhibits

There will be a small but very interesting loan section this year. Lack of space has prevented us accepting all the offers of exhibits, but we are greatly obliged to those friends whose treasured possessions are on view. Of particular interest to track-owning clubs will be the exhibit of the West Riding Small Locomotive Society who, through the courtesy of Mr. W. D. Hollings, show a small section of their fine new track at Blackgates. Of historical importance will be a fine model of a colliery pit engine, dating from



Mr. W. D. Hollings with his partly-finished $1\frac{1}{2}$-in. scale model of L.M.S. dock shunting locomotive, Fowler design. Gauge of model $7\frac{1}{4}$ in. (Loan section)

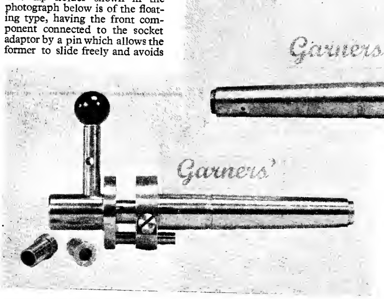
1862, and a model of a table engine reputed to be made by Trevithick, both being lent by Mr. E. J. Howlett. Agriculture will be represented by an "Usher" steam plough from Mr. C. E. Shackle, and a most attractive miniature man-in-armour comes from Mr. D. L. Butcher. A beautiful model of the *Implacable* from Lloyds will please ship lovers. These are only a few items from a most interesting loan section, which this year will be displayed in the Lecture Room upstairs, where it can be inspected quietly and should not on any account be missed.

General Information

The General Manager of the Exhibition is Mr. E. D. Stogdon whose office will be found on the Dais. In charge of all the competition and loan models will be our Chief Steward, Mr. W. R. Dunn, who has assisted in the arrangement of the exhibits for many years past and is well known both to competitors and visitors. A previous Championship Cup winner, and an experienced engineer, his advice will be much appreciated. Messrs. Keith-Prowse the well-known theatre agents will have an office at the main entrance, where they will be pleased to assist any visitors requiring seats for theatres or other shows during their stay in London. I hope all who come to the Exhibition will enjoy the show. The spirit of friendliness will be found everywhere; no one need be nervous of asking questions or for introductions to others of mutual interest. The "M.E." Exhibition is unique in this respect, it is a reunion for the brotherhood of model engineers, and a perfect opportunity for newcomers to the hobby to set their feet on the right path.

Tap and Die Holders for Lathe Tailstocks

AMONG the selection of small tools and lathe accessories exhibited by Messrs. T. Garner and Son Ltd., of Barnsley, on their stand at THE MODEL ENGINEER Exhibition, special attention is drawn to an entirely new range of tailstock tap and die holders, two types of which are illustrated herewith. The tap holder shown in the photograph below is of the floating type, having the front component connected to the socket adaptor by a pin which allows the former to slide freely and avoids dragging the threads of the tap. Spare bushings are available to suit various sizes of taps. The die holders, as shown in the photograph above, are supplied in sizes to take standard $\frac{13}{16}$ in. or 1 in. circular dies, and both fixed and floating types are available.



AN AIR-SEA RESCUE LAUNCH

by W. J. Hughes

HAVING built several free-lance boats among other things) during my modelling career, I decided it was about time I built a model of a " real " boat. I had a fancy for an A.S.R. launch, and after studying photographs of the various types, decided finally on the Walton. I particularly liked the way in which the lines of the superstructure harmonise with those of the hull—one or two of the others look as if an untidy collection of chicken-houses had been dumped on deck !

Commercial prints were sent for, and a start was made. Then seeing an advert of the actual builders in *Jane's Fighting Ships,* I sent to them requesting further information. They proved most helpful, sending detailed prints of the superstructure, layout of bridge and deck fittings, guard-rails, masts and aerials, etc. They also supplied names and addresses of the several makers of the winch, anchor, searchlight, turrets, and other fittings ; on application all these people supplied detailed prints of their products, which were scaled down as necessary when the fittings were being made.

I have the pleasure, therefore, of knowing that my fittings are " right," within the limitations of the scale and of the fact that this is a working-model.

The boat was honoured at the 1947 exhibition of the Sheffield S.M.E.E., by being awarded the Open Trophy of the Sheffield Ship Model Society for the best ship model of any type in the show. (See THE MODEL ENGINEER for May 29th, p. 649.) The bare hull had won first prize in the power boat section at the 1946 exhibition.

I have prepared the accompanying " cut-away " drawing of the hull to show the method of construction, and in conjunction with this the following description should give the reader a pretty clear idea of it.

Mr. W. J. Hughes' model Walton " Thames " A.S.R.L. This model has been entered, among others, by the Sheffield society for the Club cup, at this year's " M.E." Exhibition

The hull is 32½ in. long, i.e., ½-in. scale of a 65-ft. boat, and maximum beam is 7¾ in. The keel or backbone and the bulkheads are of 5/32-in. ply, of which I had a few odds and ends left over from a pre-war job. Each bulkhead has a 5/32-in. slot cut centrally for approximately half its height, which fits in a slot cut for appproximately half the depth of the keel, similar in principle to the partitions in egg-boxes. The bulkheads, of which there are six, excluding the transom, extend above deck level to form the foundation of the superstructure.

These parts having been cut out, a building-jig was made by ploughing a groove 5/32 in. wide and ⅝ in. deep down a 33 in. length of 2¾-in. × 1-in. deal. Notches 5/32 in. wide were then cut square across the jig at intervals, corresponding to distances between bulkheads, so that when the latter were slotted into the keel, the whole assembly could be held square and rigid by fitting it to the notches in the jig.

The parts were now cemented together, and placed in the jig to set, after a careful check-up had been made to ensure squareness and freedom from winding. The transom is fixed to two blocks cemented and screwed to the keel.

While the cement set, the chine and gunwale stringers were taken in hand. Some builders of this type of hull make each stringer in one length, bending it round the bulkheads from bow to transom, but I prefer to shape mine in three or four pieces from the solid. I think this method results in a more rigid hull, and does away with the risk of warping it during fitting.

Some well-seasoned deal (slats from shelter-bunks) was planed to $\frac{3}{8}$ in. thick, and the pieces for the stringers were cut from this. They were notched over some bulkheads and butted to others (e.g., gunwale stringer aft starts at No. 4 bulkhead, notches over 5 and 6, and butts up to the transom). They are fitted in pairs, port and starboard, working from the bows, and screwed and cemented in place.

Shaped pieces of deal were cemented at the bottom edge of the keel, between bulkheads, for subsequent fixing of the lower skins; and between bulkheads 4 and 5, where the engine was to come, reinforcing bearers of $1\frac{1}{4}$ in. $\times$ $\frac{5}{8}$ in. deal were cemented and screwed. Of course, the bottom sides of these were shaped to a bevel corresponding to that of the bottom skin.

A sloping slot was cut in the ply keel for reception of the propeller-tube, which was further held by supporting-blocks (suitably grooved on the inside faces) being cemented and screwed to the keel, forming a kind of sandwich.

Strips of $\frac{1}{4}$-in. square section were also fixed flush with the edges of the bulkheads to facilitate fixing of the skins.

Waterproof plywood of 3/64 in. or perhaps 1 mm. thickness is now available for the purpose of skinning, but at the time I had to rely on some very open-grained 1 mm. two-ply which had done service as blackout shutters. It was very badly buckled and warped, but by careful selection, enough was obtained to provide two pieces for sides and two for the bottom, with a few odd pieces left over for decks and superstructure.

The shape of each side-piece was obtained by holding the ply against the framework, and drawing round the latter in pencil. In cutting, $\frac{1}{8}$ in. overlap was alowed all round, and the piece was carefully fitted at the bows. It was then cemented and pinned in position, with a screw here and there for good measure; the second side was similarly fixed.

All screws and pins were of brass, by the way—if iron ones are used, they will rust, to the detriment of the surrounding parts, especially the plywood.

The overlap at chine, gunwhale, and transom was planed off flush with a small, finely-set plane.

This successfully accomplished, pieces were cut oversize for the bottom skins, and the inside edge of each trimmed carefully to fit up to the keel. After fixing, the overlap was planed off at chine and transom.

The bottom skin actually was stopped short at bulkhead 1, the space forward of this being filled by a deal block, cemented and screwed in position, and faired off after fixing. This block is partly to add strength at a vulnerable place, and partly because the ply might prove a little difficult to fit here.

After using the boat-modeller's best friend, plastic wood, and rubbing down well, the skin was reinforced with draughtsman's linen, of which the stiffening had been washed out. First of all, strips about $\frac{1}{2}$-in. wide were cemented over all joints; when dry, these were rubbed down at the edges so that they would not show through the final covering.

Each covering piece (five in all—bottom, sides, and transom) was liberally coated with "Durofix," and stretched, pulled, and smoothed down with the fingers until all wrinkles had disappeared—a somewhat messy business, but cellulose thinners on a rag soon cleaned the hands. After the cement was dry, overlap was trimmed off, and the other pieces applied in turn, after which the hull was rubbed down again.

Talking of cement, I used "Durofix" throughout the building of this boat, as I have always found it very satisfactory. It is waterproof and strong, but joints must be a decent fit, and the cement must be used as directed. Usual disclaimer!

The hull interior now received three coats of dark green aircraft dope.

Decks and Superstructure

Decks were cut from the two-ply, and small deal blocks cemented to the under-surface where fittings were due to be fixed. The side and aft decks were laid first.

Before fixing the forward upper deck, ventilating trunks had been built from sheet balsa to lead under the wheelhouse from the forward cowl ventilators to the engine-room. Then the sides of this part of the upper works were fixed, the windows being "glazed" with celluloid, and the roof or deck—call it what you will!—cemented down to $\frac{1}{4}$ in. $\times$ $\frac{1}{8}$ in. balsa longerons butted to the bulkheads. Rubber bands held it down to the camber until the cement had set; the sloping part aft of the vents was fitted similarly. The turtle-deck right forward is a piece of solid balsa left slightly oversize and faired off with glass-paper after cementing.

The wheelhouse structure was next framed up, mostly in $\frac{1}{4}$ in. $\times$ $\frac{1}{8}$ in. balsa, and a floor of $\frac{1}{16}$-in. balsa sheet was laid. The two-ply sides and front were stuck on, the windows being "glazed" in celluloid; the interior was painted in grey glossy dope before the roof was placed in position.

The roof was of $\frac{3}{8}$-in. balsa sheet, carefully fitted to the front of the bridge windshield, but left oversize on the other three edges. It was realised that the balsa would not "hold" the various fittings to be attached to the roof, so where these were to come, holes were chopped out and filled with plastic wood to hold the necessary screws and pins.

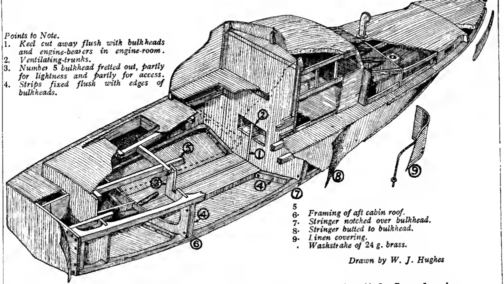
After fixing the windshield, the wheelhouse roof was painted grey inside, and fixed in place, when a few minutes' work with glasspaper soon gave the lovely streamlined shape which is a feature of the prototype.

Bridge and aft cabin sides were framed up in $\frac{1}{4}$ in. by $\frac{1}{8}$ in. balsa too, with the sides them-

selves cut from the dwindling supply of two-ply sheet. To give access to the engine-room, the whole of the aft-cabin roof is made detachable, the two-ply being pinned and cemented to a framing of ¼ in. × ⅜ in. deal. For the same reason part of the bridge deck slides out.

The sliding hatch was made to work, it being intended originally to exhaust the engine through this aperture.

It might be thought that the extensive use of balsa in the superstructure would prove a source of weakness, but actually it is surprisingly strong—and several ounces saved above the C. of G. is well worth while!



A "Cut-Away" drawing to show method of construction of the Walton Air-Sea Rescue Launch

Masts and Aerials

The mainmast is of streamline section, made from mahogany, fitting in a socket silver-soldered up from brass. Mast band is of brass, and has two sockets for cross-trees and three eyelets for stays. The eyes are bent up from fine pins, and soldered into No. 70 holes hand-drilled in the band—I have no drilling-machine. The mast cap is an "insulator" turned and filed from plastic. Cross-trees are tapered from 3/32-in. brass rod, fitted at ends with bands which have two eyes each, for stays and signal halliards. Stays, halliards, and aerials are of nylon fishing-line (breaking-strain 8 lb.).

Masts fore and aft are tapered from ⅛-in. brass rod, fitted with caps, mast bands, eyes and cleats, and with two stays of 22g. brass wire. Sockets were turned from brass, that for foremast being silver-soldered to a wood-screw for fitting to the deck. Rear-mast socket has a spigot which is a tight fit in a hole in the deck, and covers the top of the rudder-post, of which more anon. It was eventually cemented in with "Bostik."

A lantern-stanchion made from 3/32-in. brass rod fits in a socket on the wheelhouse roof. At its head it carries the anchor light and signalling lamp, with the steaming-light affixed to a lower mast band—the lights were made from Perspex.

Aerial spreader-rings are ⅜-in. dia. by 1/32-in. thick, turned down from dark-brown plastic rod. A brass jig was made for drilling the six No. 70 holes in each, and another jig facilitated the building-up of the aerials. "Insulators" are short ends of a white plastic knitting-needle on which I trod accidentally on the very night I wished to make the insulators! Quite a coincidence, wasn't it?

Masts, lantern-stanchion and cross-trees are painted with walnut aniline stain dissolved in clear cellulose, to represent wood, but bands and sockets are left bright, being tinned to represent galvanising.

Ventilators

A brass punch and die were turned for making the cowls of the vents, which were punched from 26g. copper sheet, four annealings being necessary. They were soldered to ⅜-in. brass tube, and a $\frac{5}{16}$-in. drill poked "up the spout" to make a way through. A very thin copper wire beading was sweated to each cowl-rim, and a base-flange sweated to each tube.

The midship ventilators lead direct into the engine-room, and from the forward ones the trunks lead air under decks and wheelhouse to engine-room, as it was intended to cool the engine by fan.

In addition to the cowl-ventilators, four dummy mushroom type are fitted to decks, and two to wheelhouse roof. These were turned from brass rod and tinned.

Gun-Turrets

The turrets were scaled down from Messrs. Avro's prints, the link mechanism and mountings

of the guns being silver-soldered up from brass wire. Breech-blocks and gunners' seats were filed from brass and gun-barrels turned from 18 g. nickel wire.

Barbettes were turned from plastic tube and secured to deck by 10-B.A. screws from underneath. Gun-mountings are soldered to stepped brass rings which rotate in the barbettes, but the guns do not elevate or depress.

Transparent domes were moulded in halves from celluloid sheet, the halves being joined together by celluloid strips representing the armour-plate behind the gunner. These were cut from extra moulded half-domes, as were pieces representing the front armour-plate. The completed domes were cemented in the rotatable brass rings, and strips of aluminium foil 3/64-in. wide by .007-in. thick were cemented on to represent the metal framing of the domes. These and the "armour" were painted black.

Deck Fittings

The stemhead roller, over which the anchor chain passes when the anchor is down, is designed to fair in with the lines of the stem and foredeck. In the model it is fabricated from brass.

The winch is a model of a ratchet-type made by Messrs. Simpson-Lawrence, and contains more than twenty separate pieces of brass. An 80 lb. C.Q.R.-type anchor is fitted in chocks aft of the winch, its cable being a piece of jewellers' chain. Parallel with it, in clips, lies the operating handle of the winch.

Six fairleads were filed from brass, and here a tension-file proved very useful. Four raked bollards were built up from brass, as were two deck-cleats. All these fittings are "galvanised," and are fastened to the deck with fine pins.

Guard-rail stanchions on the prototype are of galvanised tube; those on the model are tinned silver-steel $\frac{1}{16}$-in. diameter, drilled No. 70 at the top for the nylon "wire," and fitted with flanges at deck-level. A jig was made for use in drilling, and another to ensure that all stanchions were the same height from the flanges. The foot of the stanchion protrudes $\frac{1}{8}$ in. below the flange, and is forced into a hole in the deck.

Handrails on bridge and aft cabin roof are tinned brass wire, supported by knobs made from small split pins. The flanges for these are the small brass cup-washers used as thrust-washers by our aeronautical colleagues.

Other Fittings

The electric horn is turned from brass rod, and silver-soldered to a stub of brass wire which is forced into the wheelhouse roof. Sidelights are of coloured transparent plastic, their streamlined mounts being filed from brass and tinned.

Turned from brass rod, the searchlight has "bulb" and reflector, and the Perspex front is protected by a wire guard. A hand-grip is fitted at the back.

The Carley float (*not* a rubber dinghy, please!) is carved from solid balsa, and has a net floor with balsa slats stained to represent teak. Two paddles are fitted, and the hand-ropes are made from linen thread. The float will be attached to a linen line wound on a reel in the bottom of the launch, so that should the boat sink, the float will rise to the surface to show where the "wreck" is. This should only be in exceptional circumstances, however, because the whole forward half of the hull is divided into seven watertight compartments, which should keep her afloat even if she capsizes.

Two lifebuoys were turned from plastic tube, and wrapped with strips of fine cambric, which was doped white. The R.A.F. ensign is of the same cambric, coloured with children's pencil crayons, and doped with clear dope. It was then cut out with scissors, and pulled diagonally to give it that "airborne" effect. The dope, of course, stiffens it and also prevents the edges fraying.

The rudder-post is spring-loaded, so that a friction disc soldered to the stock bears on another fixed to the hull. Thus the rudder will hold any position in which it is set. The locking-nut is concealed by the rear mast-socket.

Engine-Room

And now, please spare my blushes! Obviously, the correct motive-power for this boat is a petrol-engine, and my original intention was to fit one of 4.5-c.c.—this is the reason for ventilating-trunks and sliding-hatch.

But I have decided now to fit an electric motor, for several reasons. The first and most important of these is that I have two young daughters—no, no sons!—who *can* press a switch, but who would find a small I.C. engine too much to deal with. Next, the water I use is in the centre of a residential area, and is also frequented by fishermen, some of whom look daggers even at a model yacht—it "disturbs the fish"! Out of consideration, therefore, I have tabooed the I.C. job. Thirdly, I have no desire for sheer speed, and I think the electric motor will give me a nice scale speed. In addition, at 10 m.p.h. or so, a boat takes some stopping.

At the time of writing, the motor is not installed, but I am carrying out tests with an old hard-chine hull to determine a suitable ratio for the reduction gear. The best working-speed for the motor is 6,000 r.p.m., and I am making up gear-boxes with ratios of 1—2, 1—2½ and 1—3 to see which gives the best performance with the highest motor speed.

The propeller is a 3-bladed naval type, 2⅛-in. dia. by about 3-in. pitch, mounted on a $\frac{3}{16}$-in. stainless steel shaft, which runs in phosphor-bronze bearings in a light-gauge brass tube. No gland is fitted.

Other Points of Interest

There are still a few fittings to be made, including bridge-compass, Aldis lamp, speaking-tube, and taboo-rails for the turrets. Rescue nets are made, but still have to be fixed.

Colours are as follow:—

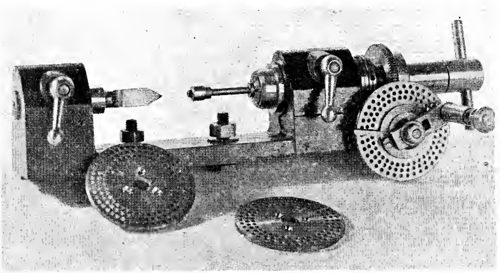
Hull: Black topsides, red boot-topping, white dividing-line, white numbers. Gunwale rubbing-strake left "bright"—i.e., clear cellulosed. R.A.F. roundels at bows. Decks and other horizontal surfaces: Golden Orange. White numbers with black edging on fore-deck; R.A.F. roundel on deck aft.

Vertical Surfaces: Medium naval grey.

(*Continued on next page*)

THE "QUICKSET" LATHE ATTACHMENT

READERS have expressed a desire for further information on this device, which was briefly described in our issue of February 13th of this year, in the series of articles on "Milling in the Lathe." It embodies a cast-iron frame, with fixed standards or headstocks for front and back cen tres, machined on the base for attachment to with two locking rings for end play adjustment. It is bored to take draw-in taper collets, a $\frac{3}{8}$-in. diameter collet being supplied with the attachment, and extra collets, $\frac{1}{4}$ in. and $\frac{5}{16}$ in. are available if required. A clamping screw and lever, similar to that of the back centre, is supplied for locking the spindle.



a standard type of vertical slide, or directly to the cross slide of the lathe or milling machine. The standards are bored to receive a dividing spindle, and a plunger type rear centre with clamping screw and hand lever.

Provision for dividing consists of a steel worm and gunmetal worm wheel, the latter having 90 teeth, which is most convenient for indexing in degrees or minutes of arc. Three division plates are supplied, each having three rows of holes, and produced from jig-bored master plates. These cover all the more common divisions from 2 to 5,400, and unusual prime numbers can be obtained by using special plates. Sector arms are provided to simplify counting of holes.

The spindle is accurately machined and fitted, having the tail end screwed with a fine thread,

We are informed by the manufatcurers, the Quickset Toolholder Co. Ltd., 10, Floriston Gardens, Stanmore, Middlesex, that this attachment is used in their own works for cutting camera and instrument gears to fine precision limits. The largest gear admitted is $2\frac{1}{2}$ in. diameter, but a simple modification enables much larger gears to be cut ; it is also extremely useful for fluting taps, reamers, or milling cutters, squaring or splining spindles, and many similar operations which occur almost daily in the model or experimental workshop.

The above firm also manufacture collet attachments to fit Morse taper sockets, taking collets from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. diameter, lever-feed tailstock drilling attachments, and parting-off tool boxes to suit $3\frac{1}{2}$ in. Drummond or similar type lathes.

An Air-Sea Rescue Launch

(Continued from previous page)

These were the colours of the prototype. The open grain of the two-ply was filled with "Alabastine" filler after a coat of priming-paint. This was rubbed down, and followed by three more priming-coats and two of enamel, with rubbing-down between each.

Inspector Meticulous might say that the paint should be a matt-finish, but my answer to him is that the water is not too clean, and enamel cleans up much more easily after a run than matt paint.

It is interesting to recall that when chatting to a visitor at the Exhibition, he revealed that he had been coxswain on a Walton A.S.R.L., among others. Naturally we had a very interesting talk, and I took it as a high compliment that he was unable to find any points of criticism.

Incidentally, my boat has been directly responsible already for persuading at least two other people to build A.S.R.L.'s. I wonder if this article will persuade any more ?

LOBBY CHAT BY "L.B.S.C."

Followers of these notes are once more complaining that not enough "lobby chats and Curly tales" are being included, so let's see what we can do in the way of what certain folk at Westminster might call "temporary appeasement." Mention of Westminster calls to mind, that according to statistics, a two-year-old's vocabulary consists of about 2,000 words, increased to four times that amount at fourteen; if he just grows up "ordinary-like," it might run to ten thousand or so, but if he takes to journalism it may reach the twenty-thousand mark (I'll say it will!). If, however, he lands at Westminster, it will pass 30,000. Well, the merchants who compiled that, had never been in a locomotive shed. I once saw a boilermaker's mate drop the end of a firebar on his pet corn; and the remarks he passed would have licked Westminster to a frazzle, in number, variety, and—ah, um! consistency, shall we say? They were certainly very much to the point, which is more than can be said for many speeches I have both heard and read about! However, let's get going, so pass the tea-bottle, Marmaduke—if there's any left!

My reference to the Eaton Hall Railway, in the notes on the origin of the "grasshopper" valve gear, have brought in several interesting letters referring to both that line and its predecessor at Duffield Bank; Mr. H. F. Wedge, of Knebworth, gave some interesting extracts from a book called "Minimum Gauge Railways," and Mr. M. Milford, of Repton, went one better, by forwarding a copy of the book itself. This clears up several points which were either not mentioned, or erroneously stated, in the issue of the *Railway World* from which I quoted. The inventor of the "grasshopper" gear, Sir Arthur Heywood, and the "Mr. Percival Heywood" mentioned in the *Railway World* article, were one and the same person; and he was some person at that! Right away back in 1874 he started to construct a 15-in. gauge railway single-handed, partly as an experiment, and partly to demonstrate the commercial possibilities of a little line for the haulage of both goods and passengers in places where there were no full-size railway facilities, and where potential traffic would not have warranted the construction of a full-sized railway, even of light variety. The Duffield Bank line was the result. It was fully equipped, even to the provision of a dining-car and a sleeping-car; not exactly necessary on a line one mile long, but just to show it *could* be done.

On the Duffield main line, the sharpest curve was 25 ft. radius, and the stiffest gradient 1-in-20; on the branches and sidings there were curves of 15 ft. radius (on 15-in. gauge!!) and grades of 1-in-10 and 1-in-12, so it was obviously impossible to use locomotives which were simply reduced copies of the 4-ft. $8\frac{1}{2}$-in. gauge types. Sir Arthur, therefore, designed the locomotives to suit the job; and very ingenious they were, too. The book gives illustrations and descriptions of three of them; *Effie*, 0-4-0; *Ella*, 0-6-0; and *Muriel*, 0-8-0. They had launch-type boilers constructed by Messrs. Abbott & Co., of Newark (one could hardly expect to build 15-in. gauge boilers single-handed!) these boilers having a circular firebox in the rear part of the barrel, so that nothing went down between the frames. Each had a huge dome, and was fed by a Holden and Brooke injector. The most interesting and ingenious part was the running-gear. A six-wheeled engine with fixed wheelbase would never have been able to take the curves, so the wheels were arranged with a radial motion. The axles ran in ordinary axleboxes, had outside cranks and coupling-rods, and were driven by the cylinders in the usual manner; but the wheels were mounted on each end of large tubular castings, something like a cycle hub. The centre one in the 0-6-0, and the second and third in the 0-8-0, could slide from side to side whilst the end axles were connected to the outer tubes by a ball-and-socket joint in the middle; and the wheels were thus able to adjust themselves to the curves, whilst still receiving a positive drive via the sliding or ball-and-socket joints.

Sir Arthur states in his book, that the engines gave every satisfaction on the Duffield line, where they ran for many years, but information from correspondents says that they weren't so hot after being transferred to the Ravenglass and Eskdale line, when that road was converted to 15-in. gauge. The boilers, which made enough steam for the mile-long home track, found the job too much for them on the much longer runs on the Eskdale road, and had frequently to "stop and blow up" as enginemen say. I have here at the present minute, a photograph of the eight-coupled erstwhile *Muriel*, converted to a tender engine, with a much larger boiler of the ordinary locomotive type.

Regarding the valve gear, Sir Arthur states that he designed a modification of one of Mr. Charles Brown's Swiss valve gears, the latter being also the "parents" of the valve gear designed by David Joy. Sir Arthur's gear is clearly shown on the locomotives illustrated in his book, and is conclusive evidence as to who was the original designer of the valve gear embodying a swinging link connected to the big-end, which, in turn, operated a pair of dieblocks working in Hackworth type straight guides above it, by a vertical connection near its centre. Whether the swinging link (the actual "grasshopper") pointed forward or backward did not affect its originality; in fact, for reasons stated in my notes on the gear, the original Heywood version gave by far the better steam distribution, by virtue of the longer radius rods, than the so-called "corrected" gear.

It was Sir Arthur himself who undertook the construction of the Eaton Hall line, and for a time worked on it personally, instructing unskilled assistants in the gentle (?) art of platelaying. He also supplied the locomotive and rolling stock, all of which were built in his miniature railway works at Duffield Bank, which was fully equipped, even to possessing its own foundry; the only castings which came from outside

sources were steel castings from Hadfield's, of Sheffield. Sir Arthur did considerable propaganda work in the cause of the narrow-gauge light railway as a commercial proposition, and it was a triumph for him when the Light Railways Act of 1896 was passed; but alas! it was too late. The application of the internal combustion engine to road vehicles, and the repealing of the "Red Flag Act," which made it lawful to run them on the "King's Highway," put the signals against the development of the light railway, and the few that were built under the Act have practically disappeared. Even the Eaton Hall line itself, is now no more, the owner having found it more convenient to use road transport; and what was left of it—track, rolling-stock, and accessories, has been purchased by the Romney, Hythe and Dymchurch Railway and transported to Kent, for use on that line. The only purpose served by these small railways at the present time, is that of amusement; even the "R., H. & D." only exists by virtue of its claim to novelty as the "World's Smallest Public Railway," and the enthusiasm of its owners. It could never survive really serious bus and lorry competition. Practically the same might be said of the Eskdale line; at one time it obtained considerable revenue from carrying stone from the crushing plant at Murthwaite, down to the L.M.S., but the narrow-gauge trains have lost the job, as standard gauge rails now go right up to the plant. There are, of course, plenty of narrow gauge lines still operating, such as those at Rhyl and other places, and at the Dudley Zoo, but they are just "holiday attractions," and not to be confounded with a small railway "earning its own living," in a manner of speaking, by carrying passengers and freight in the same manner, and under the same conditions, as its larger relations using 4 ft. $8\frac{1}{2}$ in. tracks. Narrow-gauge lines in the Colonies and other places abroad, still operate commercially, but they are on a different footing altogether, due to local conditions, and are outside the scope of our little chinwag.

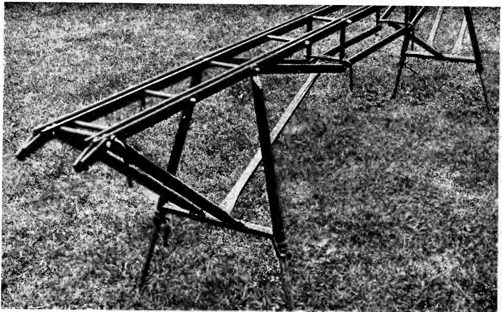


Photo by] [C. J. Grose

Section of Mr. S. R. Pateman's folding portable track, erected ready for use

Some "Galloping Ground"

And now, may I tell you what old Curly's dream of delight would be, had I the money and could get the necessary labour and material? Well, I'd just like to buy up the site of a disused branch of the Southern Railway, say the bit between Basingstoke and Alton, or between Midhurst and Chichester, and equip it with a fine multiple-gauge line, say, from $2\frac{1}{2}$-in. to $7\frac{1}{4}$-in. double track on twin viaducts, of the type used by the West Riding Small Locomotive Society, but using rustless rails of correct section. I would provide proper flat cars, fully sprung, fitted with cushion seats and footboards, and powerful brakes. There would be a small water crane, coal stage, and supply of oil every mile or so, for use of the smaller engines. Then I would not only see what my own locomotives could do, in the way of speed and hauling power, but invite any locomotive builder in any part of the country, to come and try his engine over the line, and give all the interested kiddies in the neighbourhood free season tickets. A crazy idea? Maybe, but I guess those few of our fraternity who had the pleasure of driving over the late Bro. Wholesale's road at Bursledon, wouldn't think it crazy; and tell it not in Gath, but I shouldn't be at all surprised to see a multiple-gauge line for little locomotives, springing up beside the main line

of the Romney, Hythe and Dymchurch Railway. Not for its full length, of course, but long enough to test out the capabilities of any of the engines I have described in these notes, for example. A nod is as good as a wink to a blind horse!

A Novelty in Portable Tracks

Mention of small gauge lines reminds me of a fine idea in portable tracks, carried out by Mr. S. R. Pateman, an active member of the Sutton Club. Our worthy friend set out to build a line which was entirely self-contained, easily erected and dismantled, rigid, and adjustable for height; and he surely succeeded in doing the job. I had the pleasure of witnessing a demonstration, and it certainly filled the bill in every respect. The reproduced photograph shows a small piece as erected ready for use. The rails are of bar steel, and the substructure partly bar and partly tube. By pulling out the bent handles, the cantilever can be folded flat, thus taking the minimum of space when packed for transport. The tube legs are furnished with extensions made from rod, locked in any position in a manner somewhat similar to a lathe tailstock barrel, so that height adjustment is easy. Circular feet are provided for use when the track is erected on soft ground; and hooks at each end, engaging with studs on the adjacent section, prevent any chance of the sections coming apart.

Mr. Pateman has also made some passenger cars, fitted with footboards and leg shields, as shown in another picture. These are fully sprung, and have brake gear; but if I might offer a friendly criticism, they are too long for four wheels only, but should have been supported on two four-wheeled bogies. The builder's idea was to provide for easy re-railing, when any kiddy riders fidgeted about and got a car off the road; but a three-passenger load on two axles only, makes it hard for the engine, despite ball-bearing axleboxes, and on a curve, the angularity between wheel and railhead, causes a severe grinding action between railhead and flange, with consequent friction and excessive wear. Other car builders, please take note!

Ssh!

Incidentally, the Sutton fraternity are up against a problem which might obtain in other localities, viz., the question of noise. Their ground at Chatham Close is bounded on three sides by houses, the inhabitants of which, for some unknown reason, are very hostile, and have complained of noise, especially from petrol engine exhausts; so the club's railway track will have to be erected so that the noise of the trains is reduced to a minimum. They have already adopted the concrete substructure, and it remains to find out the quietest form of roadbed. Being a vice-president of the club, and anxious to help, if possible, I thought maybe the track committee would like to test my own road for noise, or absence thereof, so gave a demonstration to two of the committee, and the secretary, who were rather impressed by the absence of roar and rattle, and the effortless running of "Olga," the old L. & N.W. 4-4-2 tank engine; but it wasn't all due to the track construction, and here is a hint from full-size practice, if you want quiet running.

On the engines of the old L.B. & S.C. Railway, we could always tell where we were, without troubling to look, by the row. The chalk cutting at Merstham gave a dull echo, and the rock cutting on the Three Bridges-East Grinstead line a louder one. Crossing a bridge with a low brick wall at each side, produced a "swishing" sound like waves on the shingle, only continuous; passing close to a high brick wall sounded like a gale blowing through trees, and a close-boarded fence produced a sort of "rippled echo." Every

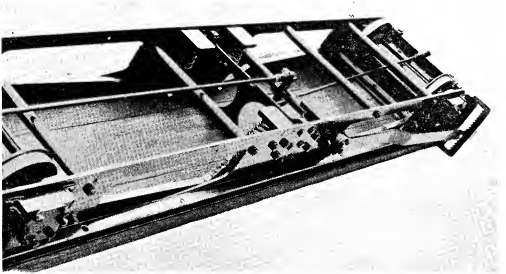


Photo by] *Underside of one of Mr. Pateman's cars* [*C. J. Grose*

time the engine went under a bridge, the latter shouted "Yah!" at it, and in no uncertain voice at that; whilst passing through a tunnel at a mile a minute or more—especially Balcombe Tunnel, when the roof was wet—was enough to make a brass monkey deaf in both ears, what with the noise of the engine, the exhaust beats, the roar of the train and the rattle of the wheels over the joints, all seemingly multiplied over a thousandfold in the confined space. No need to mention crossing bridges and passing stations, except to say that each had its own peculiar echo which we soon learned to recognise. The quietest-running sections of the line were the tops of embankments, or "fills" as they are called by Trans-Atlantic railway folk; in fact, the nearer the train approached to the alleged home of the angels, the less it tried to disturb them, in which respect it was a little more considerate than any womming-bird, even in peacetime. Anyway, the moral of all this is, that if you aim for the minimum of noise on your railway, make the substructure as substantial as possible, also remember the title of a recent popular song, and "don't fence it in." When a small line is close to a board fence, the latter acts as a kind of sounding-board, and multiplies every bit of noise made by the locomotive and rolling-stock. Dick Simmonds had an experience of this on his own line, the straight sections of which, run close to the garden fences on each side. When a section of the fencing was removed for repair, the difference in sound, as the train passed the gap, was very noticeable. My own line is quite open, which in some measure accounts for the quiet running of my own engines.

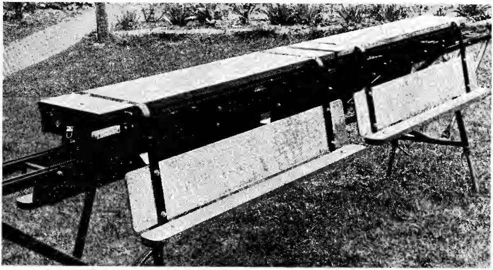


Photo by] [*C. J. Grose*

Mr. Pateman's passenger cars

An Automatic Injector Water-Valve

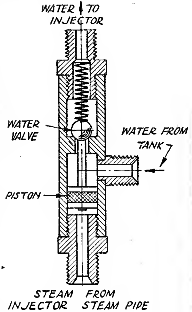
Queries about injectors come in regularly in my correspondence, and one of the points raised by beginners, is whether it is possible to operate them by a single handle; what our radio friends would call "one-knob-tuning." As a matter of fact, I have done a bit of experimenting in that line, and have schemed out two workable solutions; just lately have been experimenting with various combinations of cones, to make certain of a quick start every time.

It may happen that in due course I might describe a new type of combination injector with single-handle control; nobody knows exactly what old Curly has up his sleeve! I've learned a lesson or two from the use and profit which other people have made from "information supplied." Meantime, anybody who needs single-handle control, can apply same to any of the injectors I have described in these notes, by fitting an ingenious device on the water pipe, for details of which I am indebted to our worthy friend, Mr. G. A. Flanagan, the chairman of the North London S.M.E.

Mr. Flanagan's idea is shown in the accompanying sketch. It consists of a small spring-loaded ball-valve closing the waterway, something like the arrangement of my whistle-valves; but instead of the ball being pushed off its seat by a hand-operated plunger-rod, the latter is operated by a tiny steam cylinder, the piston of which is connected to the plunger-rod. The steam end of the cylinder is connected to the steam pipe leading to the injector, by another pipe, quite open, without any valve on it. The action is simple; on opening the injector steam-valve, steam immediately flows down the branch pipe, and acting on the underside of the little piston, forces it up and pushes the ball off its seat, allowing water to pass into the injector. On shutting off steam, the spring returns the ball

to its seating, and stops the flow of water. For stationary work, as on Mr. Flanagan's vertical boiler, the automatic valve is screwed direct to the water inlet of the injector; but for locomotive work, the valve should be placed as near to the injector as possible, the position of a locomotive injector below the level of the tender tank being too low to admit of the valve being directly attached to it. The gadget will, of course, work in any position, either vertically, inclined, or horizontal.

The valve, naturally, is either fully open, or fully closed, and cannot regulate the amount of water passing through it; to do this, an ordinary screwdown valve should be fitted somewhere between the automatic valve and the water tank. A properly proportioned injector will work dry without regulation of the water valve, to about 30 or 40 lb. below blowing-off pressure in the boiler; but at lower pressures, adjustment of the water supply is needed to stop any dribbling at the overflow. My own regulating valves are situated behind the tender drag beam, and operated by a "brake handle" as shown in the recent footplate view of "Jeanie Deans." On tank engines the valve is worked by means of an extension handle in the coal bunker.



The Flanagan automatic injector water-valve

In passing, if an injector "knocks off" and fails to restart, blowing steam from the overflow, the usual cause is too small a gap between the two halves of a Holden-and-Brooke-type combining cone, or too small slots in a Sellers cone. The steam must have an *unobstructed* passage to escape via the ball valve, otherwise, it builds up pressure in the combining cone, and keeps the water out. This trouble also causes bad starting and slow pick-up.

Now a request to beginners—and other folk! If you make a jigger and it refuses to jig, please don't pack up your failure and fling it at my devoted head, in a manner of speaking, with a demand to put it right, or describe in detail what is wrong with it. Life's too short, especially at the present stage, and I haven't the time; check over for yourselves, and you'll surely find the trouble. For example, the last specimen, *supposed* to be made exactly to instructions, had a body made from a huge solid block of metal weighing nearly four times as much as one made to my specification; this in itself would have held enough heat to upset the working. The steam cone had a blunt point, one of the very things I warned about; the drills used had cut the wrong sizes, the tapers were incorrect, and the whole job very poor workmanship indeed. If the maker of the non-injector had given his gadget a "once-over" with my instructions in front of him, he would have saved his time and my own, and the cost of a two-way ticket. 'Nuff sed!

The L.N.E.R. Wants Models

THE London and North Eastern Railway is proposing to form a collection of models, subject to certain conditions, to serve as a visual record of L.N.E.R. practice during the past twenty-five years, and also that of the pre-grouping constitutent companies merged into the L.N.E.R. in 1922.

The models may represent locomotives, passenger and freight rolling-stock, signals, track, stations, or any other relevant features. They should be, preferably, to 7 mm. scale, though good models in other sizes would be considered. Working models would be preferred, and in the case of electrically-driven locomotives, the motors should be suitable for operation on 6 to 8 volts, d.c.

Any reader who is willing to sell, give or bequeath to the L.N.E.R. Co. a model suitable for the purpose referred to is invited to communicate direct with Mr. George Dow, Press Relations Officer, L.N.E.R., Dorset Square, London, N.W.1.

We would remind readers that the various railways (pre-grouping) involved are: The Great Northern, the North Eastern, the Great Eastern, the Great Central, the Hull and Barnsley, the North British and the Great North of Scotland.

*REBUILDING A LATHE

by G. H. Reed

THE feed system of the machine is by a back shaft and worm gearing to a shaft running across the top of the saddle. This shaft can be connected by a dog clutch to the train of gears for sliding feeds, while the drive for the cross feeds is taken off the worm wheel to the cross-slide screw through a cone clutch which is engaged by a threaded sleeve.

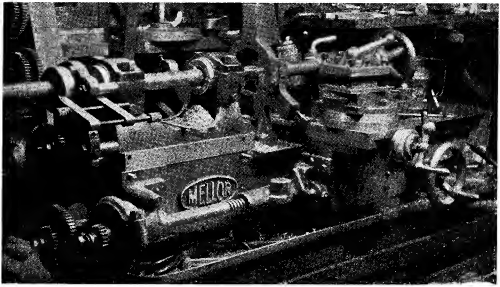


Photo by] [*Bernard Reed*

Boring out the main bearings

Raising the headstock to increase the centre height entailed fitting a larger gear in the train of feed drive gears from the tumbler reversing box. Originally, the feeds for general purposes were too fast on sliding feeds but about right on the cross feeds. Fitting a larger gear in the train had the effect of reducing both speeds, but unfortunately the new cross-slide screw of 8-t.p.i. as opposed to 5-t.p.i. further reduced the feed. Thus, at the moment, one feed is still too fast and the other is much too slow, but short of fitting a sort of Norton gearbox to the back shaft, there is little that can be done about it.

Headstock Bearing Modifications

Although it would appear that at last the lathe was in apple-pie order, its performance left much to be desired. Parting-off was a trial of patience and only light cuts could be taken in normal turning. Suspicion rested on the P.B. shells of the main bearings and in a flash of enthusiasm it was decided to remove these shells and cast white metal in their place, with the idea of boring out the bearings in position. Little difficulty was experienced in casting the bearing metal. The machined surface of the cast-iron where the P.B. shells were originally seated was carefully tinned with ordinary solder and plenty of flux. The caps were similarly treated and were found to be easier to do since it was possible to get them much hotter without doing any damage. The mould shown in the sketch consists of two semi-circular boxes to form the end-faces of the bearings while the steel tube forms the rough bore through which the boring bar passes. The moulds were used for each half-bearing since they are merely clamped in position.

After casting the white metal, the mating surfaces of each pair of bearings were faced up by filing, such that the two joints were in the same plane and as near as possible $4\frac{1}{2}$ in. above the lathe bed. With the idea of providing adjustment at some later date, .002 in. shims were put under the caps before clamping down for boring. The boring operation is shown in the photograph which was taken after one of the bores had been finished to size but not faced off. The boring bar is a length of 1 in. bright mild steel and at one end it runs in the inner race of a ball race and it is the inner race which is clamped to the lathe thrust bearing plate. The race was used merely because it was a snug running fit on the bar. The other end of the bar runs in the fixed steady. The

*Continued from page 153, "M.E.," August 7, 1947.

bar was turned by hand and fed by the tailstock. As can be imagined, the alignment of the bar is a vital point, particularly to get it parallel with the bed and at exact centre height. Lateral discrepancies could be corrected by adjustment of the headstock on the bed, within certain limits. Actually the bar was located with the aid of a dial indicator mounted on a long extension clamped to the tool-post, and as the tailstock barrel is the same diameter as the bar, the aligning was pretty straightforward though rather tedious.

To assist the setting of the cutter in the bar, a $\frac{1}{4}$ in. × 40-t.p.i. set-screw was provided to push the cutter out. The bearings were faced at both ends and for appearance sake, the outer diameters were radiused off with a curved tool.

Theoretically, it should not be necessary to scrape such bearings, but these were scraped, if only to provide lodgment for lubricating oil.

After final assembly the lathe was given extensive trials to see what it would do, and the results were most satisfying. The feature that decides the heaviness of the cut that can be taken seems to be the power of the 1/3rd h.p. motor. With a well-ground tool parting-off is a joy, and to quote an example, it will part off 3 in. phosphor-bronze at 180 r.p.m. on the self-acting mechanism and give a perfect finish to the parted-off piece. It has been found very necessary to use thin hydraulic oil on the bearings owing to their size and the low power available, but this is not by any means an unusual fault with lathe bearings.

The photograph of the complete lathe shows a V-belt drive in place of the original flat belt which went up to an overhead countershaft driven through fast and loose pulleys. The new arrangement is much more compact and, having a four-step pulley gives a greater and somewhat wider choice of headstock speeds. Incorporated in the large pulley of the countershaft, is a single-plate clutch of motor-cycle pattern, complete with cork inserts in the plate, though with the difference that the operating rod is actuated by a cam so shaped as to keep the clutch out if necessary. Mechanically, this is a poor arrangement with such a clutch since it is possible to leave the clutch out inadvertently for a long period, which means that the springs are left in compression and are liable to become weakened. However, to date it has given no trouble nor has it shown any tendency to slip. Operation of the clutch is by the lever at the right-hand end of the countershaft.

The most recent job in the way of improvement of the lathe has been to bore out the tailstock casting $\frac{1}{16}$ in. oversize and to fit a new barrel. The poor fit of the original barrel was particularly manifest in drilling operations, when a true running hole was the exception rather than the rule, due of course, to the lack of rigidity of the drill chuck. The new barrel was first turned from $3\frac{1}{2}$ per cent. nickel-steel and fitted with a new phosphor-bronze nut. The boring bar is supported in a bush carried in the fixed steady and to ensure the accurate alignment of

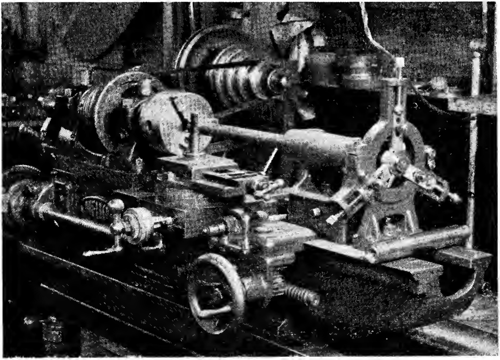
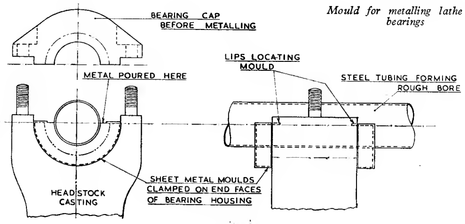


Photo by] [*Bernard Reed*

Re-boring tailstock casting for oversize barrel



Mould for metalling lathe bearings

this bush with the axis of the headstock, the steady was adjusted to the bush while the latter was still in the chuck in the process of its manufacture.

For the boring operation the tailstock was coupled to the saddle so that the automatic feed could be used, and was clamped by the normal clamping device such that it was free to slide along the bed but prevented from rising up. The cutting tool in the bar was a tungsten-carbide cylinder boring cutter, though for some unknown reason there was a difference in diameter of .0005 in. in the finished bore from end to end. This difference was finally removed by lapping and the new barrel is now a perfect fit in the casting.

As can readily be appreciated, the great point about this method of reboring the tailstock, is that the bore cannot fail to be parallel with the lathe bed in both directions, and in this particular instance where new bearings have been fitted to the headstock, it ensures absolute alignment of the lathe.

The Thrill of Achievement

WE have received the following little bit of "live steam" from an old reader in Johannesburg, whose enthusiasm is at bursting point, but who wishes to remain anonymous. He has certainly felt the thrill he so vividly describes, and his feelings will, we are sure, find an echo in the hearts of many other readers. He writes :—

"When I was a lad, showmen's steam-driven roundabouts were in their heyday. They fascinated me, and I resolved that should an opportunity come my way, I would build a miniature switchback roundabout. Time rolled on, but the idea was ever at the back of my mind. By degrees, I got a workshop equipped, and then one day, the result of years of scheming and labour was in position on the exhibition floor. The machine was fairly large, about 1½ in. to the foot scale. This enabled the centre-engine driver to stand upright while the machine was in motion.

And now for the thrill part of it ! I did not know then if it would work satisfactorily. The barrier around the exhibit (about 14 ft. square) was crowded with people six-deep. Many had never seen a machine like it. The 'big noise' declaring the exhibition open was the signal for the compressed air stands, the passenger-carrying railway, and *my* effort to burst into action.

The safety valves on the main centre-engine were just sizzling as the gauge hand pointed to about 90 lb. The little organ-engine was already working merrily. The organ (brilliantly lit) began putting out a stirring military march with a lovely counter-melody.

And then ! A touch on the siren valve—a deafening shriek, as only the showman's siren could make . . . . I opened the throttle a wee bit . . . . *What was going to happen* ? . . . . I felt keyed up to the limit of endurance.

Then, to the accompaniment of the organ music, the engine 'took up the load,' the gondolas began to gather speed on the undulating circular 3-rail track, the furnace-fire glowed white-hot, the pumps were working perfectly. Not until the engine was running at the maximum speed for safety (about 180 revs. per minute) did I venture to look around. The spectators were all excitement; to them the whole thing was marvellous.

But to *me* the thrill at seeing the fruits of nearly ten years' spare time (well sprinkled with setbacks and disappointments) was indescribable; no words could adequately convey the absolute pleasure, relief, and thankfulness at achieving what I set out to attain.

Probably there will be hundreds who will visit this year's 'M.E.' Exhibition, when they see the wonderful array of exhibits (many of them working) who will wonder if *they* can ever reach that goal of achievement which seems so far off. To all these good people, I say : 'Get down to it, never be in despair, overcome difficulties, but always let your work be the best you can do, and ultimately you will, each one of you, get a similar thrill as I did on that memorable evening some years ago'."

JET PROPULSION

Part I — by "ARTY"

THIS is the first of two articles on jet propulsion on a small scale, and deals with the various types of units and their possibilities. The second will consider some aspects of testing these units.

Jet propulsion units can be divided into the following classes :—

(*a*) Straight through propulsive ducts or athodyds.
(*b*) V-1 type ducts.
(*c*) Turbo-compressors.
(*d*) Compound units (*e.g.*, a petrol engine driving the compressor of a jet engine).
(*e*) Rockets.
  (i) Solid fuel.
  (ii) Liquid fuel.

To my mind, propulsive ducts of the "open pipe" or straight through type are not suitable for ordinary model work. In full scale work, reasonable efficiency is attained only at speeds closely approaching supersonic and, of course, above. One hardly expects small scale aircraft to attain this velocity, at least while retaining conventional aspect and not looking like the work of a ballistic expert.

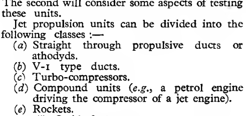


Fig. 1. *Diagrammatic representation of "False" propulsive duct*

Pressure Ratios

It can easily be seen that appreciable pressure ratios in the compression part of the cycle (yes, the true straight through propulsive duct should have a working cycle), which is entirely due to ram pressure, can not be attained by the usual variety of model aircraft. The ram pressure, P, is given by :—

$$P = \frac{e\ V^2}{2g} \text{ lb./sq. ft.}$$

where :—

e/g is the density of air in slugs/cubic ft. (say, 0.002378).

V is the velocity in ft./sec.

Let us consider an aeroplane proceeding happily on its way at 30 ft./sec.

$$\text{Pressure rise, P} = \frac{0.002378 \times 30^2}{2 \times 144} = 0.00743 \text{ lb./sq. in.}$$

This is not much of a pressure rise and who would attempt to run a reciprocating engine without a compression stroke?

Incidentally, I have seen a straight through propulsive duct unit, as shown very diagrammatically in Fig. 1, in operation. It was mounted on the end of an arm swinging round at the top of a post and, strangely enough, it produced almost enough thrust to maintain motion when the arm was swung round by hand. This slight thrust was due to the reaction from the mass of fuel being discharged (on the same principle as the rotating lawn sprinkler) and possibly to some ejector effect. It could not have been operating on the true straight through propulsive duct principle for two reasons :—

(*a*) No approach compression at that speed.
(*b*) No proper shaping of the pipe as it was a constant diameter throughout.

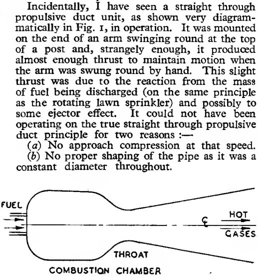


Fig. 2. *Liquid fuel rocket*

On the other hand, the shuttered or V-1 type duct, which operates on a fundamentally different principle, probably could be satisfactorily developed for small scale work after a certain amount of experimentation. One suggestion would be to use very light shutter(s) with small quantities of fuel supplied intermittently in a vapour form via a carburettor and touched off electrically. This alternative to the full-scale V-1 principle would obviate the necessity for "tuning" the length of the exhaust pipe. Probably most trouble would be experienced with the shutter as this would have to be very light, but still more or less explosion-proof!

Turbo-Compressor Units

Regarding the turbo-compressor units, I am rather pessimistic. For instance, to obtain a pressure ratio of 2, with a centrifugal compressor, simple theory suggests the required tip speed to be about 1,000 ft./sec., that is, if the impeller r.p.m. is 30,000, the required impeller diameter is about 8 in. Over and above this, an efficient diffuser would be required to convert the velocity head to pressure head bringing the diameter of the complete unit to somewhat unwieldy dimensions for model aircraft use.

An alternative is a staged centrifugal compressor. Assuming three stages and 1.26 pressure ratio for each stage (making an overall pressure

ratio of 2 as before), the required tip speed would be about 600 ft./sec., that is, about $4\frac{1}{2}$ in. diameter impeller running at 30,000 r.p.m. Not very attractive, especially when considering the consequent manufacturing difficulties of efficient diffusing of three stages.

A third alternative would be a staged axial flow compressor and although this too has its difficulties, it is probably more attractive.

Power to Drive the Compressor

Besides this, there is the question of obtaining sufficient power from the turbine to drive the compressor, let alone a surplus to propel the aircraft. There is in existence a four stage axial flow air turbine of about $1\frac{1}{2}$ in. diameter disc designed by experts, and constructed with all the facilities of a well-equipped modern factory tool room. When this unit is operating under optimum conditions, its overall efficiency does not exceed 40 per cent. It may well be that this figure can be exceeded, but it will be realised that it is no easy matter to design and construct a turbo-compressor unit capable of powering a model aircraft.

Driving the compressors by a reciprocating engine also has its difficulties. This does at least provide a sure supply of power for the compressor, but the design problems of that item remain. It seems unlikely, on the face of it, that the combination of reciprocating engine, compressor, diffuser, combustion chamber and jet will approach the simple reciprocating engine and propeller in overall efficiency, weight, simplicity or reliability.

Rocket units on the other hand, of either the solid or liquid fuel variety, seem to offer more hope. The problem here, however, is physico-chemical rather than mechanical. The reader can doubtless recall the simple solid fuel rockets of Guy Fawkes fame, which seem to provide a fairly appreciable thrust. Liquid fuel rockets consist essentially of a chamber (see Fig. 2). where the fuel is pumped in and ignited. The combustion generates a pressure in the chamber which is converted to velocity on expanding through the throat. This is a somewhat inefficient method of generating thrust or power on the whole, and fuel disappears rapidly. Practical points to watch are cooling the combustion chamber and preventing the throat from wearing away.

To sum up, it may be said that :—

(*a*) The straight through propulsive duct is almost impossible, except at high speeds (at least, high for model work).

(*b*) The V-1 type duct is quite practical, but would need development.

(*c*) The turbo-compressor is difficult.

(*d*) The compound unit is also difficult.

(*e*) Rocket units are fairly practical.

It is hoped that these predictions turn out to be on the pessimistic side, but only by facing up to the difficulties can they be overcome. It is possible also that new methods of propulsion will appear.

Fuel Data

By kind permission of the Editor, B. B. Low, I append some data on various fuels that may be of use to workers in this field, extracted from the well-known engineer's pocket book, D. A. Low's "Pocket Book for Mechanical Engineers."

(To be continued)

Fuel	*Calorific Value C.H.U. lb.*		*Spontaneous Ignition Temperature in Air, ° C.*	*Highest Useful Compression Ratio*	*Octane Number*	*Air/Fuel Ratio lb./lb.*
	Higher	*Lower*				
Benzene	10,090	9,700	419	>15	>100	13.2
Butane	11,800			7	90-100	15.5
Propane	12,000			10	125	15.7
Hexane	11,500	10,650	366	5-6		15.3
Heptane	11,560	10,710	330	3.75	0	15.15
Methyl Alcohol	5,241	4,762	457	5.2		6.45
Ethyl Alcohol	7,093	6,403	514	>7.5		8.97
Power Alcohol mixture, No. 1	7,780	7,170		9.5-12		9.57
Power Alcohol mixture, No. 2	8,800	8,190		6.25		11.29
Benzole	10,025	9,600	420	>7.0		13.31
Aviation petrol	11,300	10,510				14.9
Petrol, No. 1	11,280	10,500		5.5-6.0	70-73	14.8
Petrol, No. 3	11,200	10,430		5.0	66-70	14.8
Ethyl petrol				6-8	80-87	14.8
Kerosene	11,140	10,420		4.2		14.6
Tractor vaporising oil	11,150	10,420				14.6
Diesel oil	10,980	10,310				14.4
Light fuel oil	10,700	10,050				14.3
Heavy fuel oil	10,500	9,880				14.0

Table of data on various fuels

FACTORY METHODS

in the Home Workshop

by "1121"

IN THE MODEL ENGINEER for July 4th, 1946, under the above heading, the writer made some observations of a general nature on the organising of a small workshop. It is proposed now to delve a little more deeply into the circumstances which would arise should the model engineer wish to undertake any work which might involve the making of several identical or similar parts. In a commercial manufacturing establishment this would automatically involve the design and construction of special jigs, press tools, etc. It is not suggested that the model engineer should carry the organisation of his workshop to such lengths as this, but there is no doubt that a little time spent on making a few *standard* jigs, which can be adapted to produce a number of different parts, will be well repaid by the facility with which these less interesting repetition jobs can be got out of the way. There have been several excellent articles in these pages in the past, describing various types of jigs and fixtures in use in large production shops, but as far as the writer remembers there has been little said about the way in which these principles are applied in small shops where the making of so many special pieces of equipment is not justified. It must be remembered that with any jig the proportion of its cost borne by each component produced increases as the number of components decreases, until this quantity becomes so small that it is cheaper not to make a jig at all, but to put skilled labour on to producing the parts singly. Just before this stage is reached, however comes the opportunity to use, where possible, standard adjustable jigs which can be made to produce a range of varying components of similar general form.

Before setting out to design, say, a drilling jig for use in the home workshop, let us examine the rules normally followed by a tool designer in a manufacturing concern, producing a fair number of the components, with unskilled labour, with a view to ascertaining which of these rules should be applied in our own particular case.

(1) *Accuracy.* The jig must automatically locate the component from the datum faces shown on the drawing, to the required degree of accuracy.

(2) *Speed in manipulation.* The arrangements by which the component is located and clamped in the jig must be such that the loading and unloading times are as short as possible, compared with the time taken to do the actual drilling. A longer clamping time is reasonable if the actual operation is lengthy, while an inefficient jig is one that takes longer to load and unload than it does to use. Luckily, it usually follows in practice that the complicated component which is difficult to clamp is so by reason of having a large number of holes to be drilled, of various sizes and depths and at all angles, but the tool-designer's headache arises on the comparatively infrequent occasions when he is confronted by the operation of drilling a single small oil-hole in a complicated casting which is practically impossible to hold.

(3) *Foolproofing.* It must not be possible to insert the component into a jig upside-down or the wrong way round. This is not usually difficult to ensure, but it is surprising how often it is forgotten, even by experienced designers. With no intended aspersion on anyone in the machine-shop who may use the jig, it is always assumed as a matter of course that if a component *can* be loaded into a jig the wrong way round, the operator will do it considerably more often than otherwise. After all, he is not paid to think, and it is not fair to expect him to. In any case, he just may not know which way he is supposed to load the part, particularly if the jig is adaptable to a variety of components, or a left-hand and right-hand component of the same form.

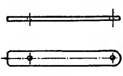


Fig. 1

The writer knew of a case, some years ago, in which one component out of a whole batch was found to have been drilled wrongly. The inspector, the shop foreman, the draughtsman who had designed the jig and the toolmaker who had made it, all tried for an hour and a half to get the component into the jig the way it had been drilled, without success. Finally, in desperation, they took it to the operator who had drilled it, and he couldn't do it either.

(4) *Burr and swarf clearance.* It is essential that the burrs thrown up round the hole by drilling should not key the component into the jig and prevent its withdrawal. It must also be possible to clean out the swarf after unloading the component, as swarf remaining on the locating faces will throw the next component out of truth. The old-fashioned cast box form of jig was notorious in this respect, and jigs are now cut away as much as possible so that the locations can be seen and cleaned.

(5) *Ease of construction.* The jig must not be so complicated that it will cost more than can be saved by its use. The designer must decide whether it will be cheaper to build it up from standard sections of metal, with screws and dowels or welding, or to machine it from the solid. In some cases it may be worth while to get a pattern and casting made. It may also be cheaper to split up the operations on a component, so as to enable a number of simple jigs to be used, rather than trying to do the whole job in an elaborate jig which is disproportionately expensive.

There is hardly need to mention that the jig must be strong enough to do the job for which it is intended, and not distort under the stress of drilling or clamping, and in some cases weight may be an important consideration. If large holes are to be drilled extra weight may be an advantage, but if a small hole is being drilled it is difficult to line up a heavy jig and avoid drill breakage. The writer remembers a large jig which was to be used for drilling a large number of small holes in a light casting. The job was complicated and difficult to locate and clamp, and an iron casting was made for the jig body, involving considerable expense. The jig turned out so heavy as to be useless, and a new body had to be cast in aluminium.

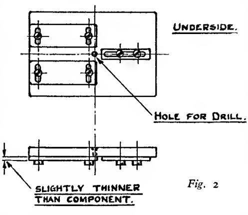


Fig. 2

The Amateur's Jigs

There are many more points which have to be borne in mind by the jig designer, but the above may be considered as the fundamental principles which must be followed if the draughtsman and his jigs are to pay for their keep.

Let us analyse these various points and see how they can be modified to suit the conditions under which the amateur will use any jigs he may make.

(1) *Accuracy.* On the whole this will in most cases be less important to the amateur than it is when unskilled labour has to be used. The principle of locating the component from the important faces as indicated on the drawing should still be followed, although it is not essential that the locating should be *automatic.* The amateur can be relied on to push the component up against the location while he tightens the clamp, if there is one, whereas in a commercial jig this would be done by a spring, or a special clamp designed to bias the component over in the right direction while being tightened down. To simplify the jig still further it might be allowable to rely merely on " nesting " the component and dispense with a clamp altogether, as the model engineer is not concerned as a rule with interchangeability of parts and may be satisfied with having to do a little fitting in the assembly of his components. A clamp is usually only necessary if the *centres* of two or more holes are concerned, to prevent the component from shifting between the drilling of the first and subsequent holes, or if a hole has to be drilled to an accurate dimension from a face by which the component is located on an assembly, such as an angle-bracket or " A "-frame to carry a shaft a particular distance above a baseplate.

(2) *Speed in manipulation.* The amateur will be very little concerned with this point, as he is not vitally interested in the seconds ticking away as is his professional counterpart. However, no harm will be done by using one's head a little when making the jig, to save, for example, fiddling about with a spanner on a hexagon clamping nut, when a wing-nut is the obvious thing to use.

(3) *Foolproofing.* This hardly enters into the question, and can be ignored where an intelligent model engineer is concerned.

(4) *Burr and swarf clearance.* Burr clearance, of course, is just as important to the amateur as in a production shop, for whether the job has to pay or not makes little difference if it can't be got out of the jig anyway. Swarf clearance is not quite so vital, as the model engineer can afford to spend a little more time in carefully wiping his locating faces clean. All the same, needless cramping can usually be avoided when designing the jig.

(5) *Ease of construction.* This will no doubt be one of the major considerations from the amateur's point of view, and it will be well worth his while to spend a little time in thought before commencing the construction of his jig, with a view to utilising any odd bits of angle-iron, scrapped castings, etc., which might be pressed into use.

It is hoped that the foregoing remarks will enable anyone who thinks a simple jig might help him with some particular job to avoid the most obvious pitfalls which can render a jig a snare and delusion rather than a saver of time and accuracy. Little mention has been made of things which will be obvious to any intelligent person, such as strength, squareness, flatness, etc., and very little more can be said on the subject without examining the pros and cons of the particular job to be dealt with.

For this reason the writer now proposes to deal with a few cases which have claimed his attention in the past, and which were sufficiently straightforward in character to afford good examples for the guidance of anybody having a simple problem in semi-mass production.

For a certain job a series of strips, similar to that shown in Fig. 1, but varying in width, length and distance of the holes from the ends, was required to be drilled, and a simple adjustable jig was made, as shown in Fig. 2, which, it is hoped, is self-explanatory. As will be seen, the jig has a fairly wide range of adjustments, which renders it useful for jobs subsequent to those for which it was originally made. It will be noticed that *both* sides of the jig are made adjustable, so that the hole can be kept on the centre-line, whatever the width of the component, or, alternatively, it can be drilled nearer to one edge than the other if required, or a tapered strip can be accommodated. Note that the guide-strips are slightly thinner than the component to be drilled, and that the component should be rested on a small piece of plate to clear the screw-heads. It is not a serious

matter if a hole is required of a size different from that in the jig: it is only necessary to use the jig for spotting through on to the component, with the jig's own particular drill, and then finish the drilling out of the jig with a smaller or larger drill as required. If the hole is to be reamed, it is usually good enough for most purposes to do this without any guide for the reamer other than the hole being reamed.

At this juncture it is opportune to point out that a mild-steel jig with a plain drilled hole in it is quite good enough to enable the amateur to drill a fair number of components with reasonable accuracy. If a large amount of drilling had to be done, however, the hole in the jig would wear oversize, and it is to prevent this that in commercial work the jigs are always fitted with dead hard bushes, pressed into reamed holes. These may or may not have heads—the modern trend is to dispense with heads, perhaps making the bush a little longer than otherwise to ensure its lining up squarely in its hole. No hard and fast rules can be laid down for the proportions of these bushes, without giving a table ranging through all sizes, which can be found in many up-to-date books on the subject. We are concerned only with providing the amateur worker with a rough guide to enable him to avoid making mistakes which would " stick out a mile " to an experienced designer. Approximately, then, for small sizes, say up to $\frac{1}{8}$ in. drilling, the wall of the bush would not be less than $\frac{1}{16}$ in., and not more than $\frac{1}{8}$ in.; in other words, about the same as the diameter of the drill, and the length of the bush would be about twice its outside diameter. In the larger sizes, this proportion would not be so great. A bush for a $\frac{1}{2}$-in. drill would have a wall thickness of about $\frac{3}{16}$ in.-$\frac{1}{4}$ in., and a length of about $\frac{1}{2}$ in.-$\frac{3}{4}$ in., and would be more likely to have a head to square it up than would the smaller bush.

The hole in the bush is not merely drilled, but ground and lapped, possibly in a special lapping machine built for the purpose, to be a very accurate fit for the drill. It must be realised that if the hole is too small the drill may seize in it, and if undue clearance is left swarf will jam between the drill and the bush with the same result. Needless to say, the bush itself is ground on the outside to be a tight drive fit in the hole in the jig. Bushes climbing up drills are all too frequent in even the best-regulated factories.

A word about reaming may now be useful, assuming that the accuracy of the job is to be such that it is essential to *guide* the reamer, and not sufficient merely to leave it to follow its own way through the drilled hole. There are two ways by which this is commonly done, one ideally suitable for the amateur and the other definitely unsuitable. We will briefly consider the latter first. This method consists of using two bushes, interchangeable in the same hole in the jig, one to fit the reamer and one to fit the reaming-size drill, i.e. slightly smaller. These are called " slip bushes," and the hole in the jig into which they are a good *push* fit has itself to be bushed with a " liner," as it is termed, to prevent wear due to the constant changing of the bushes. The slip bushes must be prevented from riding up the drill or reamer (which they will do if left free), usually by a small shouldered screw whose head projects over the top of the head of the slip bush. A slight turn in an anti-clockwise direction enables the slip bush to be withdrawn by virtue of a small arc cut out of the edge of its head to clear the head of the screw. The heads of the slip bushes are knurled, and of large diameter, to facilitate their removal.

This arrangement is costly to make, requiring accurate workmanship, and, incidentally, rather a lot of room on a small jig; and has been displaced in some factories by a simpler method, as follows. A plain fixed bush to fit the *reamer* is provided in the jig. Through this *a drill of the same size as the reamer* is inserted, and the component dimpled only. *The reaming-size drill* is now put through the component, using the dimple as a centre. The reamer is now put through the bush, and by virtue of being guided will correct any slight inaccuracy in the position of the drilled hole. This method, involving as it does the use of only one fixed bush, is ideal for the amateur's use. No doubt the amateur of average skill *could* produce slip-bushes, but it just wouldn't be worth his while when the other method is just as good and so much simpler.

Just one further small point—any form of bush with a head is a nuisance in a jig in which drilling is required to be done from two opposite directions, such as a jig for drilling a casting, or a bent-up sheet-metal component. Obviously, it will be necessary to stand the jig on a face in which a bush is fitted, and if this bush has no head it will be flush with or below the surface of the jig, and will not get in the way. If a slip-bush or other headed bush is used, however, it will be necessary to provide the jig with feet or runners to clear it.

(*To be continued*)

For the Bookshelf

The Watch Repairer's Instructor. By F. W. Britten. (London: The Technical Press Ltd.) Price 7s. 6d., postage 3d.

The present scarcity of clocks and watches brings into greater prominence than ever the importance of the repairer, and competence in this form of craftmanship is just as essential today as ever, although the facility and equipment for carrying it out have considerably improved. This handbook, written by a well-know.n authority on the subject, follows up an earlier publication, *The Watch Jobber's Handbook*, by **P. N. Hasluck**, which enjoyed great popularity for many years. In the new work, the treatment of the subject has been brought completely up to date, and the author stresses the importance of learning how to use the watchmaker's lathe —the old " turns " now having become entirely obsolete—and also to understand the principle of escapements in general use, and how to correct their faults. Written in simple and lucid language, this book should be extremely helpful to those seeking a reliable introduction to the practice of watch repairing.

Editor's Correspondence

Steam Raising

DEAR SIR,—I am a follower of "L.B.S.C." and I used to use a cycle-pump when getting up steam on my "Fayette," and it was hard work.

During my holidays, I saw in a wireless dealer's shop, some *ex*-Government blowers, 12 and 24-volt tappings, brand new, for 15s. I bought one and, connecting through an old "Trix" transformer, I held it over the chimney of my engine and set it going.

I can get up steam in five minutes by this method, and will give any reader a demonstration at any time. I have a 50-ft. track in my garden, and would be pleased if any reader would bring an engine to run on it.

Station House, Willington, Beds. — Yours faithfully, W. BERRY.

Forcing-Screws

DEAR SIR,—It is really surprising how rarely, in model work in general, provision is made for forcing-screws. In case anyone does not know what these are (and judging by their rarity in model work, there are apparently many people who have never heard of them or seen them) they are screws so arranged that cylinder covers, steam-chest covers, steam-chests themselves (when made separate from the cylinders they serve) etc., may be removed without damage or trouble. In full-sized work their use is pretty well universal and very necessary.

It is by no means unusual to find, when the time comes to overhaul a model steam engine, that there is considerable difficulty in breaking the joints and moving the parts mentioned; and, not infrequently, models which have had a lot of use betray obvious signs of this trouble in marks and burrs where some sharp instrument (and not always a sharp one!) has been brought into play to prise things apart. A very little forethought and extra work when making the model will serve completely to eliminate this trouble, and, at the same time, the maker will have the satisfaction of knowing he is following correct practice. Actually, the trouble is accentuated by good workmanship in the first place; the better the fit and the less "slop" in screw-holes, spigots, etc., and the more effectively the joint is made, the greater the difficulty in breaking it when necessary.

Cylinder covers should have two tapped holes diametrically opposite to each other and on the same circle as the holding-down bolts or studs.

The size may be slightly less than the studs, bolts or set-screws. With steam-chest covers or steam-chests the holes should be symmetrically arranged, two, three or four being used and spaced as most convenient. In the case of steam-chests which are usually fairly deep, there is no need for the threaded portion to be full length; a length equal to one and a half times the diameter of the thread is ample and the rest of the hole may be made a clearing size.

It is not usual to leave the forcing-screws in place, and in the case of steam-chests, unless they were of special type, it would be impossible, but a set should be kept with the engine spares and spanners. This is a small matter, but quite an important one, from both practical and realistic points of view. It is just one of those points which might easily tip the scale in awarding marks to two otherwise equal models in competition, and it has its very definite advantages when the time comes to carry out overhauls; it is easy to do and there is no excuse for neglecting it.

It is not claimed that it improves the working of the model (it obviously does not) nor is it claimed as being essential. Building models at all is not essential but if one does build them, one may as well do the job right.

Wealdstone. — Yours faithfully, K. N. HARRIS.

Model Jet Engines

DEAR SIR,—Reference your comments in "Smoke Rings," MODEL ENGINEER, July 24th, 1947, in connection with jet model engines on the principle of the German V.I. pulse jet cycle—I have one of the American engines you mention called the "Dynajet." It may interest readers to know some details of this engine, for which I am building a special flying boat, because the usual bugbear of propellor torque reaction is so alluringly absent for the take-off-water.

The engine in question is 22-in. long and has a screwed-in head fitted with light alloy fins, a flap valve and a jet and tyre pump connector. The body of the engine is merely a sheet steel shell with a spark-plug fitted just behind the "business" head.

The jet (which is a fixed one and not adjustable), is connected to a petrol tank in the model. The height of the lift of fuel is very important.

To start. The tank is filled and the operator connects up his tyre pump and by pumping air down the venturi shaped head, sucks up fuel from the tank. This is mixed with the air and blown down the combustion chamber body. A 6-volt battery is attached to an old Ford trembler coil which delivers a constant series of sparks at the sparking-plug. This ignites the fuel mixture (normal gasoline). When the engine starts the coil lead to the sparking-plug is detached and the engine pulses away on its own as regard to ignition. The air-pump is also detached.

Considerable care must be given to the mounting so that the model is not burnt by the very hot flame tube.

Except for the starting paraphernalia the whole affair is gloriously simple!

Bournemouth. — Yours truly, C. E. BOWDEN.